

VI Semester Syllabi – Fire Technology

Sr. No.	Course Code	Course Name	L	T	P	Credits
1	FT3CO17	Fire Engineering II	3	0	2	4
2	FT3CO18	Nuclear Safety & Radio Active	3	0	0	3
3	FT3CO19	Hazard Identification & Risk	4	0	2	5
4		EL-03	3	0	0	3
5		EL-04	3	0	0	3
6	EN3MC01	Self-Study (MOOC)	1	0	0	0
7	FT3CO20	Fire Fighting & Field Training IV	0	0	4	2
8		OE-2	3	0	0	3
		Total	20	0	8	23
		Total Contact Hours	28			

EL-03

FT3EL08 Rescue Equipments and
Techniques

**Open Elective - 2 Offered by Mechanical
Department**

ADVANCED ENTREPRENEURSHIP
RENEWABLE SOURCES OF ENERGY
BUILDING MAINTENANCE & REPAIRS
WATER & WASTE WATER ENGINEERING
ENGINEERING GEOLOGY
TRANSPORTATION ENGINEERING
LINEAR INTEGRATED CIRCUIT
DATA COMMUNICATION
INTRODUCTION TO SYSTEM
AUTOMATION

EL-04

FT3EL02 Fire Safety Codes and Standardization
FT3EL09 Safety in Health Care waste Management



Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
FT3CO17	Fire Engineering II	3	0	2	4

UNIT I

Fire fighting vehicle and appliances, Crash tender, Rescue tender, Fire engine design, Hydraulic platform, Turn table, Hose laying tender, Control vans, Fire pumps and primer and cooling system, Pump house, Storage of fire, Growth of fire, Method of fire extinguishment, Hydrostatic tests, Active and passive fire protection.

UNIT II

Fire service equipment: Water cum foam monitor, Fire water piping, Hose box, Hose reel, Hose fittings- Coupling, Different types of branches, Branch holders, Nozzles, Flash fire, pool fire, Deep-seated fire, Spoilover, Adopters and ramps, Bhopal gas tragedy case study.

UNIT III

Ladders: Features of Extension ladder, Hook ladder, Turn table, Hydraulic jack, Small gears, BLEVE, UVCE, Boilover, Ropes and lines, Types of wires and ropes, Explosion hazard and risk.

UNIT IV

Breathing apparatus and associate equipments, SCBA, Modern compressed air breathing apparatus, JSA, Fire protective clothing and PPEs, Domestic fuel and LPG, Ventilation, Case study of Refinery fires.

UNIT V

Unsafe acts and unsafe conditions, Accident investigation reports, Safety committee, Safety audit, Safety inspection report and analysis, Importance of training, European and Indian classification, Safety posters, Safety display, Duties of safety officer.

Text books

1. The manual of fire ship – 6 – A, HMSO
2. Elementary principles of rescue by Govt. Of India , ministry of Home Affairs
3. Rescue Service Manual by HMSO

References Books

1. Rescue –Civil defense handbook by HMSO
2. Rescue tender for Airfields by ISI
3. Relevant ISI special appliances and equipments
4. Manual of fireman ship book no. 24

List of Practicals:

1. To study of Crash fire tender.
2. To study of PPEs.
3. To study of SCABA.
4. To study the different nozzles.



5. To study the types of ladders.
6. To study the types of ropes, knots and hitches.
7. To study the development of fire effects.
8. To study the introduction of fire.
9. To study the types of hose
10. To study the types of nozzles

W. R. R. R.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
FT3CO18	Nuclear Safety & Radio Active Materials	3	0	0	3

UNIT I

Electromagnetic waves & Spectrum, radioactive phenomena, alpha, beta, gamma rays, rate of disintegration, half life, decay laws, statistics of counting radioactivity, age of earth, types of nuclear reaction, transuranic elements, biological effects of instant & long time exposure, unit of radiation.

UNIT II

Method of measurement, radiation detection & monitoring equipments, film badge, lithium fluoride powder, dosimeter, ion collection, pocket dosimeter, Geiger-muller (GM) counter, scintillation counter, radiation placard & labels.

UNIT III

Techniques of personnel radiation protection, general techniques, radiological control, external radiation, types of exposure, ICRP limit, DWL, maximum permission level of contamination, determination of radiation, contamination & decontamination

UNIT IV

Nuclear power plant, case study of accident like Fukushima Daiichi 2011, TMI 1976, Chernobyl 1984, nuclear fission & fusion reaction, genetic hazards of radiations, radioactive waste disposal, safety regulation process public awareness & emergency preparedness.

UNIT V

Safety of nuclear reactors, prevention / control of radiation emergencies, setting up zones, fire officer responsibilities, protection from external radiation, smoke detectors, radiation detectors, infrared detectors, heat detectors, foam extinguishers, ALARA, fire sprinkler system

Text Books

1. M.M.E.L.Wakil, "Nuclear Power Engineering", International Text Book Co.
2. U.S Stermann "Thermal and Nuclear Power Stations", MIR Publications, Moscow,
3. B.M. Rao, Radioactive Materials, Himalaya Publishing House

Reference Books

1. G.W. Whyte, Principles of Radiation Dosimetry, John Wiley and Sons, New York
2. H. Blat, Radiation Hygiene Handbook, McGraw Hill
3. J.C Collins Radioactive Wastes, their Treatment and disposal, E.F.N. Spon Ltd., London

Signature

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
FT3CO19	Hazard Identification & Risk Assessment	4	0	2	5

UNIT I

Hazard and risk, Types of hazards – fire, explosion and toxic gas release, Structure of hazard identification and risk assessment. Identification of hazards : Inventory analysis, Fire and explosion hazard rating of process plants -The Dow Fire and Explosion Hazard Index, The Mond Index, Plant layout and unit hazard rating, Preliminary hazard analysis, Hazard and Operability study (HAZOP), What If analysis, Case studies.

UNIT II

Plant availability and process reliability : ways of improving plant availability, MTBF and MTTF, the reliability function, failure rate, bathtub curve, probability relationships, simple reliability estimation. Estimation of frequency of occurrence of a hazard : The logic tree approach, set theory and Boolean algebra, application to probability, Boolean manipulation.

UNIT III

Fault tree analysis – logic symbols, minimal cut set, logic gates, fault tree quantification Event tree analysis – notation, event tree construction, advantages and disadvantages of ETA. Failure mode and Effect Analysis (FMEA) – methodology, criticality analysis, corrective action and follow-up.

UNIT IV

Consequence modeling : Source models – discharge rate models, flash and evaporation, dispersion models. Explosions and fires – vapour cloud explosions, flash fires, physical explosions, BLEVE and fire ball, confined explosions, pool fires, jet fires. Effect models –dose-response functions, probit functions, toxic gas effects, thermal effects, explosion effects – Software application for effect and damage calculations.

UNIT V

Quantification of risk : QRA, Vulnerability analysis, accepted and imposed risk, perception of risk, risk indices, individual risk and societal risk, acceptance criteria for risk, ALARP, Presentation of measures of risk – risk contour, F-N curve.

Text Books

1. High-Rise Fire & Life Safety by B. Hagan.
2. National Building Code of India.
3. S.Mannan, Loss prevention in the Process Industry, BH Publishers

Reference Books

1. Fire Protection and Maintenance of Aircraft by N.F.P.A.
2. The Fire Hazards of Fuelling Aircraft in the Open by D.S.I.R., H.M.S.O. London.
3. High-Rise building fires and fire safety – N.F.P .A.

Signature

List of Practicals: (Pl. expand it)

1. To study of Toxic chemicals.
2. To study of runaway reactions.
3. To study of flammability and explosion.
4. To study of corrosive materials.
5. To study of FMEA.
6. To study of ALARP.
7. To study of HAZOP.
8. To study the types of hazard
9. To study of QRA
10. To study of MTBF

Handwritten signature

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
FT3EL08	Program Elective- I Rescue Equipment's and Techniques	3	0	0	3

UNIT I

Hydraulically And Pneumatically Operated Tools And Equipments: - Hydraulic Jack, Hydraulic Cutter, Hydraulic Expander. Air Lifting Bags, Electric Power Tools: - Electric Cutter, Electric Saw, Chain Saw etc. Small Gears: - Their types, Applications and working principal Ladders: Constructional features, their types, Material and applications Ropes: - Their types, material and applications.

UNIT II

General Introduction- Emergency Rescue Tender, Water Tender, Foam tender, Multipurpose Tender Hydraulic Platform, Turn Table Ladder, Canteen Van and Ambulance; Fire Extinguishers: - Their types and Applications. Rescue by Ordinary Means.

UNIT III

Different Types Of Knots & Hitches And Their Applications In Emergency Carries & Drags: Fireman carry, two men carry, three man carry, four man carry, chair carry, stretcher carry and different types of Drags. Rescue problems and their remedies, Rescue from High rise buildings, Rescue from major disasters Earthquake, Flood, Drought, Tsunami etc. Rescue from Fire incident

UNIT IV

Respiratory Equipments: Respiratory Physiology, Composition of Air, Breathing, Breathing Rate, Calculation of the capacity & time duration of the B.A. Set. Artificial Respiration and their techniques, Renunciator,

UNIT V

Gas masks: Their types, Constructional features, Working Principal and Applications. B.A. Set: - Their types, Constructional features, Working Principal and Applications.

Text Books

1. Rescue Service Manual by HMSO
2. Relevant ISI special appliances and equipments manual of fireman ship book no. 244
3. Rescue tender for Airfields by ISI.

Reference Books

1. The manual of fire ship- 6- A by HMSO.
2. Elementary principles of rescue by Got. Of India, ministry of Home Affairs.
3. Rescue - Civil defence handbook by HMSO.

Handwritten signature

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
FT3EL02	Program Elective-III Fire Safety Codes and Standardization	3	0	0	3

UNIT I

Specification of Rescue And Fire:

Fighting equipment and appliances viz., TP, Water Tender C. F. T. and I.S. Standard (IS 948, IS 950 IS 6067, IS 10460 ,IS 4989 (PART-1) IS -4989 (PART-3),IS -949,IS 951,IS 944', IS 2930,IS-947 IS 6070, IS 957 ,IS-946 ,942 , IS-8090, IS-2190, IS-903 IS-636

UNIT II

Salvage Tender Emergency Tender, Rescue tender, DCP Tender IS-10993, IS-949

UNIT III

Code concerning construction and design of buildings. NBC -1983

UNIT IV

Code of practice for construction of temporary structures and pandals IS -8758 Codes relating to fire ratings of materials used.

UNIT V

Municipal Bye- Laws in relating to fire prevention, industrial fire Prevention and Protection enforcement.

References

1. National Buildings code by Indian Standard institution
2. All relevant INDIAN Standard Specification and code of practices
3. Related N. F. P.A. Codes, Standard and recommended Practice.
4. DGMS (Indian) Director General of Mine Safety Mines regulations.
5. U.L. Standard, Specification
6. Factory Act.



Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
FT3EL09	Program Elective-II Safety in Health Care Waste Management	3	0	0	3

UNIT I

Definition & characterization of health-care waste - sources and generation of waste, Physicochemical characteristics. Hazards of health-care waste, public health impacts of health care waste. Health-care waste management planning - waste management plan for health care establishments, management of health-care waste from scattered small sources, waste minimization, recycling and reuse.

UNIT II

Handling, storage and transportation of health-care waste-waste segregation and packaging, onsite collection, transport and storage of waste, offsite transportation of waste. Treatment and disposal of health care waste - Incineration chemical disinfection; wet and dry thermal treatment, Microwave irradiation, land disposal, Inertization.

UNIT III

Treatment and disposal methods - Infectious waste and sharps, pharmaceutical waste, cytotoxic waste, chemical waste, wastes with high heavy - metal content, pressurized containers - radioactive waste. Collection and disposal of waste water - hazards of waste water from health care establishments - waste water management. Workers' protection, cytotoxic safety, Emergency response.

UNIT IV

Epidemiology of nosocomial infections and prevention. Training for health care personnel and waste management operators.

UNIT V

Minimal programmes for health care waste management - waste segregation, safe recycling, treatment & disposal, management of hazards health - care waste by waste categories.

Text Books

1. A Pruss, E. Girault P. Rushbrook (Ed.): Safe Management of Waste from health care activities. World Health Organization, Geneva
2. K U Mistry, Fundamentals of Health Safety and Environment
3. C. Ludwick, Solid Waste Management, Springer

Reference Book

1. G. Tshobanoglous, Handbook of Solid Waste Management
2. J. Ridley, Safety at Work
3. V.I Grover, Solid Waste Management,

Handwritten signature

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN3MC01	Open Learning Course	1	0	0	0

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
FT3CO20	Fire Fighting & Field Training IV	0	0	4	2

The field training based on the following is to be performed

1. Hose Drills General movements to be noted for handling delivery hose, hydrant Drill (3-Men)
2. Hydrant Drill (4-Men).
3. Pump Drills Trailer Pump Drill (Four Men), Trailer Pump Drill (Six Men), Motor Fire Engine
4. (without escape)/Water Tender Drill (Six Men), First Aid Hose reel Drill (Three Men).
5. Ladder Drills: Extension Ladder (Four Men), Hook Ladder Drill, Hook Ladder Drill (One Men),
6. Hook Ladder Drill (Two Men), Hook Ladder Drill (Three Men), Fire escape Ladder Drill (Six
7. Men), getting a Branch to work up on Escape Ladder, getting a Branch to work from an escape
8. Ladder, Turn Table, Ladder Drill (Six Men), Hydraulic Platform. Drill (Six Men).
9. Foam Drill (F.B.-2) Foam Drill with inline inductor (Six Men)

The field training based on the following should be given

1. Rescue Drill
2. Rescue from fire.
3. Rescue from the accidents (Road side, railway accident & Aircraft),
4. Rescue from electrocution and
5. Rescues from well.

Signature

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
OE00035	Open Elective -IIAdvanced Entrepreneurship	3	0	0	3

UNIT I

Orientation To Growth: Getting Ready for Growth, Why growth stage is different compared to startup phase, Why Product-Market fit is not enough, Case study, To assess readiness for growth, To chart a growth path

UNIT II

Customers: Expanding Customer Base-Revisit your business model and develop few variants (more business model types), Identify additional customer segments that your solution can address, Evaluate business models for the new customer segments, Re-look at the Problem Statement (can you expand the scope and scalability of your business by repositioning your problem statement?), Explore additional ways to monetize

UNIT III

Traction: Scaling-How to gain traction beyond early customers, Defining traction (in quantifiable terms) and identifying the most important metrics to measure traction, Calculate cost of new customer acquisition, Estimate your customer lifetime value (LTV), Identifying waste in your operations and focusing your team on what is important for traction

Channels and Strategy- The Bullseye framework Identify Channels using Bulls Eye Framework Measuring the effectiveness of selected channels Budgeting and planning

UNIT IV

Money: Growing Revenues-Stabilizing key revenue streams, Developing additional revenue streams (licensing, franchising), Exploring new channels and partnerships

Sales Planning-Understanding why customers buy and how buying decisions are made; Listening skills, Sales planning, setting targets, Unique Sales Proposition (USP); Art of the sales pitch (focus on customer's needs, not on product features) Follow-up and closing a sale; Asking for the sale

Strengthening Sales-Building a professional sales team, Sales compensation and incentives, Sales planning, setting targets

Improving Margins-Testing price elasticity, Optimizing costs and operational expenses, Advanced concepts of unit costing

Financial Modeling-Financial modeling of your venture's growth, Analyzing competitor and peer's financial models

UNIT V

Support: Legal-Overview of legal issues and their impact on entrepreneurs, Importance of getting professional help (legal and accounting), Importance of being compliant and keeping proper documentation, Patents and Intellectual property, Trademarks

Mentors, Advisors, and Experts-The importance of a Mentor and how to find one, Role of business advisors and experts for specific targets in your growth plan

Handwritten signature

Text Books

1. A. Mathur, Entrepreneurship, Taxmann,
2. V. Desai, Fundamentals of Entrepreneurship & small business management, Himalaya Publishing House.
3. Entrepreneurial Development by S.S. Khanka, S. Chand Publication.

References

1. S. Shane, A General theory of entrepreneurship: The individual opportunity nexus, Edward Elgar Publication.
2. J. A. Timmons & S. Spinelli, New Venture Creation: Entrepreneurship for the 21st century, McGraw-Hill.
3. R.D. Hisrich and M. Peters, Entrepreneurship, McGraw-Hill.



Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
OE00036	Open Elective -II Renewable Sources of Energy	3	0	0	3

UNIT-I

Introduction: Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India. Energy from Sun: Sun- earth Geometric Relationship, Layer of the Sun, Earth – Sun Angles and their Relationships, Solar Energy Reaching the Earth's Surface, Solar Thermal Energy Applications

UNIT-II

Solar Energy Collectors: Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects of Solar Collectors, Concentrating Collectors, Parabolic Dish, Solar Water Heating Systems, Passive Solar Water Heating Systems, Applications of Solar Water Heating Systems, Active Solar Space Cooling, Solar Air Heating, Solar Dryers, Crop Drying, Solar Cookers, Solar pond. **Solar Cells:** Components of Solar Cell System, Elements of Silicon Solar Cell, Solar Cell materials, Practical Solar Cells, Photovoltaic Panels, Applications of Solar Cell Systems.

UNIT-III

Wind Energy: Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection. **Geothermal Energy:** Geothermal Systems, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation, Associated Problems, environmental Effects.

Solid waste and Agricultural Refuse: Waste is Wealth, Key Issues, Waste Recovery Management Scheme, Advantages and Disadvantages of Waste Recycling, Sources and Types of Waste, Recycling of Plastics.

UNIT-IV

Biomass Energy: Biomass Production, Energy Plantation, Biomass Gasification, Updraft, Downdraft and Cross-draft Gasifiers, Fluidized Bed Gasification, Use of Biomass Gasifier, Gasifier Biomass Feed Characteristics, Applications of Biomass Gasifier, Cooling and Cleaning of Gasifiers. **Biogas Energy:** Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant, Biogas Plant Feeds and their Characteristics.

UNIT-V

Ocean Thermal Energy: Introduction, Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Basic Rankine Cycle and its Working, Closed Cycle, Open Cycle and Hybrid Cycle, Carnot Cycle, Application of OTEC in Addition to Produce Electricity, Advantages, Disadvantages and Benefits of OTEC

Tidal Energy: Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India

[Signature]

Text Books

1. Kothari, Singal & Rajan; Renewable Energy Sources and Emerging Technologies, PHI
2. B.H Khan, Non Conventional Energy, TMH.
3. Sukhatme and Nayak, Solar Energy, Principles of Thermal Collection and Storage, TMH.

Reference Books

1. K. Rao, Energy Resources, Conventional & Non-Conventional, BSP Publication.
2. C.S.Solanki, Solar Photovoltaics: Fundamental, technologies and Application, PHI
3. A.Tasneem and SA Abbasi; Renewable Energy Sources; PHI Learning.

